

“Experimental Determinations for Saturated Solutions.” By the  
EARL OF BERKELEY. Communicated by F. H. NEVILLE, F.R.S.  
Received March 28,—Read May 19, 1904.

(Abstract.)

The object of this research is the experimental determination of those physical constants of concentrated solutions, which are necessary for the tentative application of the gas-law equations. Saturated solutions were chosen because, presumably, dissociation is relatively at a minimum.

This part of the work deals with the densities and solubilities of the chlorides, sulphates, and nitrates of sodium, potassium, rubidium, caesium, and thallium, and also with their respective alums, except that of sodium.

The densities were determined by means of a small pipette-shaped pyknometer, of about 5 c.c. capacity, the lower end of which was turned upwards and the upper, 120 mm. long, was graduated. This was filled with the saturated solution and weighed, and from the known capacity of the pyknometer, together with the weight of solution it contained, the density was calculated. The solubility was obtained by washing out the contents of the pyknometer and evaporating to dryness, the weight of salt left giving the solubility.

The densities and solubilities were determined in two ways. In one the saturated solution, which was in contact with an excess of salt and continuously stirred, was cooled to the temperature of observation and the density and solubility determined. In the other an unsaturated solution was raised to the temperature of observation, being continuously stirred in contact with an excess of salt (in both cases the solution is kept at the temperature of observation by means of a thermostat), and the density determined at intervals of about 12 hours until constant.

This constant density and resulting solubility was averaged with the density and solubility obtained in the first method, and the mean was assumed to be the true density and solubility of the saturated solution. The observations were made at intervals of 15°, in this manner, between 0° C. and 90° C.

The constants were also determined at the boiling point of the saturated solutions in an apparatus in which steam was caused to bubble vigorously through the solution with excess of salt, until the temperature became constant, this constant temperature being assumed to be the boiling point.

The boiling point itself was not accurately determined, as it was

found that no emergent column correction could be satisfactorily applied; the pressures, however, under which the saturated solutions boiled were recorded.

The results are given in a tabular form at the end of the paper.

---

“A Method of Measuring directly High Osmotic Pressures.” By the Earl of BERKELEY and E. G. J. HARTLEY. Communicated by W. C. D. WHETHAM, F.R.S. Received April 21,—Read June 2, 1904.

This paper gives an account of some preliminary experiments made in furtherance of a scheme of work outlined by one of us in a communication to the Royal Society.\*

The ordinary method of determining osmotic pressures, *i.e.*, that adopted by Pfeffer,† Adie,‡ and others, is evidently not suitable for high pressures; the difficulty of attaching the manometer to the porous pot in a manner such that it will not move at the junction is practically unsurmountable.

It seemed likely that if a porous plate were tightly squeezed between two hollow hemispheres, the necessary conditions of stability might be attained, and the first apparatus carried out this idea. It was made by Messrs. Müller in 1901, and, being of glass, was designed only to stand moderate pressures, though it was hoped that, in a way described below, it might be used to measure indirectly the osmotic pressures of concentrated solutions. It consisted of two glass globes A and B (see fig. 1), holding the porous plate C between them. The plate was glazed round the edge, and carried the semi-permeable membrane of copper ferrocyanide on the face adjacent to the solution. A rubber ring on either side of C and between it and the glass flanges of A and B, served to form a watertight joint when A, B and C were strongly pressed together by means of a suitable brass fitting, which, however, is not shown in the figure.

It had been intended to put solutions of different concentrations in the two vessels, and measure the difference between their osmotic pressures; it was found that, although it would be possible to obtain the desired result, yet the time taken for the pressure to develop was too long.

An experiment with a solution of 114·7 grammes of sugar in the

\* Earl of Berkeley, “Experimental Determinations for Saturated Solutions,” read May 19, 1904, see p. 435.

† W. Pfeffer, ‘Osmotische Untersuchungen,’ Leipsic, 1877.

R. H. Adie, ‘Jl. Chem. Soc.,’ 1891, p. 344.